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Business Topographies: A Spatiotemporal Analysis of 150 years of Indian Business

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Abstract

One of the most growing entrepreneurial landscapes has been without a doubt in the last decade India. India, with a total population of almost 1.2 billion inhabitants, is a land of immense business opportunity within a highly competitive market. Before the eighties however, India was mainly a rural country, with a large contrast of the nexus between city and periphery. With the emergence of young generation of entrepreneurs, the economy has been growing at a rate of 8-10% for the last 20 years. The share of the service sector has increased to 60 per cent in the total GDP. The growth rate of India has increased significantly and has been consistent mainly because of the emergence of private sector in general and small business entrepreneurs in particular. The private sector has not only played a significant role in savings but also played pivotal role in investment in the country which has been creating vast job opportunities and gigantic wealth for the country. Thus, the growth of the Indian economy is mainly driven by the private sector. Worldwide the landscape of business has undertaken a paradigm shift. The developing countries have become key drivers of the trajectory of global growth. World has started looking at the growth of India and China from a business perspective, but also in a context of environmental futures. These two economies will be the biggest economies by 2035. However, the change in the industrial and entrepreneurial landscape of India raises up some importance issues related with how is Indian business developing spatially, how its concentrated its growth is and how it is related to Indian transportation systems. Using different stages of Geographic Information Systems, we will answer these three questions by methodologies found in geostatistics, neogeography and spatial analysis. By means of a database of over 3000 businesses in India, we will (i)

transform this database to spatially-explicit content through geocoding techniques which shall allow (ii) a geostatistical analysis through the creation of a Getis Ord (Local G) autocorrelation of identifying hot and cold space for entire India over time. This information will be assessed in a combination of volunteered-geographic information (VGI) where the availability of the entire road network of India shall be (iii) compiled on a spatial integrative analysis, allowing to understand the spatial relation of the Local G business hot and cold spots in relation to infrastructures and commutes. These results bring forth a novel approach of combined spatially-explicit methodologies and GIS, which for business analysis seems greatly to be missing and set out to create a new definition missing in literature: Business Topographies. A combined methodology taking forth available datasets brought from VGI related to autoregressive spatial modelling approaches shall allow a better understanding of the underlying patterns of the spatial transformation of the business landscape over time (in our case since 1850 for India) and the predictable consequences of future changes in spatiotemporal scenarios for business performance, taking into account commutes and Euclidean spatial proximity.

1. Introduction

The Indian business has seen winds of change with the change in economic policy in 1991. Prior to 1991, the success of Indian business was actually a function of licenses, contacts and understanding of the bureaucratic system. There was no competition as there were restrictions on entering into the market. The economic policy was actually inward looking and geared toward the attainment of self-reliance which was set as the objective after the dawn of Independence in 1947. During the pre-1991 period, entrepreneurship thus was passive as capital was limited as a result India had very few success stories of entrepreneurship. Due to

the protected environment till the end of 1990, the economy landed into an acute payment crisis in the year 1991. The intermediate and consumer durable industries were facing a problem of acute recession. Performance of capital goods industries was very poor, causing a great concern too. Besides, agriculture sector too did not perform well because of lack of infrastructural facilities. The Indian economy had developed structural rigidities too. Since Independence it protected its domestic industries against foreign competition with a number of devices, such as, tariffs, quotas, exchange restrictions, import licensing and other discretionary controls. Over the years, these controls and regulations were tightened to such an extent that the cost and quality structure of Indian products deteriorated and Indian products became non-competitive. Indian goods were not able to be sold in the global market without support of export credit, subsidies and other concessions. Our domestic buyers had no option but to buy high-cost-low-quality goods produced with obsolete technology. Thus, the country was paying a high price for the wide structural rigidity and inefficiency. In sum, the prevailing weaknesses in the Indian economy became prominent because of unfavorable external factors. Production and marketing apparatus did not remain fit to meet the domestic demand and compete in foreign markets. Investment, production, infrastructure and market were not of international standard. In addition, to carry forward the benefits of new policies on enduring basis, the long term issues of structural rigidity had also to be urgently addressed. This consisted of decontrolling the private sector, reforming the public sector and taking other appropriate measures so as to give competitive edge to the economy. The Government, in view of these developments and compulsions, reformulated its economic strategy and introduced the new economic policy (NEP) of which globalization was an integral part. In the year 91 each sector in the country's economy was touched by the winds of change when the government of India embarked on a series of reforms[1] which opened up

[1] a number of steps were taken by the Government under this policy and these steps greatly liberalized the

the economy and gave the private sector much more space. It went through transition and metamorphosis in keeping with the global vision of the Indian economy. The government of India liberalized the economy thus changing the business landscape which became competitive. Indian businesses which dominated the Indian markets now started facing competition not only from domestic companies but also from the multinationals that had superior technology, financial strength and deeper managerial resources. Indian economy has emerged with remarkable rapidity and is projected to move up and touch $2 trillion dollar club. This has been possible because of the leading corporate czars who have made a valuable contribution to the development of the Indian economy. In the globalized world where business is equivalent to war, competition is on the peak, small fish is eating big fish, and dexterity is the rule of the business game for survival and winning. Unless organizations move faster, others will overtake and win. Indian companies are able to capture market globally, taking advantage of emerging trends, and reaping the benefits of being first mover. These are the strategies and processes of winning and growing organizations. The Indian businesses have followed the unbeaten track and gone against the wind and shaken the existing order in the world. They courageously take on seemingly impossible challenges and boldly pursue and struggle in their transformation journey after the new economic policy. This transformation is strongly felt also at spatial level. Understanding of the spatial topology, underpinning the business landscapes may be of great importance for retail industry but also for business performance in general. This is linked to the concept of clusters that merge within specific geographic areas, and tend to be related by their distance to each other. Following the first law of Geography where Tobler (1970) states that" everything is related to everything else, but near things are more related than distant things", an intrinsic relation

economy. These include removal of:
MRTP restrictions on expansion of large industrial houses, industrial licensing regime, restriction on entry of the private sector, inefficient and distorted trade restrictions control on determination of foreign exchange rates, and restrictions on foreign investment movement towards full convertibility of the rupee.

exists over performance and space. One of the main reasons is the existence of spatial association creating a causality between aggregation of clusters over space (Miller 2004) and giving place to more complex evidence found in spatial autocorrelation where complexity also arises from the differences between autocorrelation in time and space (Cliff and Ord 1970). The attraction of investors through governments and administrations where the liberalization created a new breed of business which created enormous wealth. This gives a true picture of the new business landscape in India, which has an intrinsic spatial dimension concerning the business performance. Particularly when allied to productivity and local synergies that enable performance (Porter 2000) and generating entrepreneurial ecosystems (Pitelis 2012) where synergies of businesses are present.

2. Clustering as a transformation factor of business landscape

Much of the business landscape transformed over time. Classical literature has referred to agglomeration and scale economies to explain why business tend to join, taking advantage from proximity. But, in recent times, a vast theoretical framing was developed to extend the reasons why organizations are getting closer, linked by common interests to ease the present challenges of growing competitiveness. Most of these arguments are related to organization theory, fitting in the area of clusters and networking analyses.

After the emergence of the concept of clustering to designate a new concept of geographical and institutional proximity among companies, Porter and Sölvell (1998) also explained that a cluster offers the adequate environment for the development of a common language, social bounds, norms, and values as an advantageous social capital. This implies an intrinsic geographic dimension, where shared and similar values allow increasing performance.

A cognitive reasoning was also emphasized by Pouder and John, 1996, who explained that within a cluster, managers and decision-makers share many cognitive references, perceptions

and experiences that facilitate creative and innovative activities. If all entities within the cluster share the same propensity for creating and innovating, for risk-taking and change, then one can expect that the whole cluster will show such patterns of creation and innovation leading to increased competitive levels among companies and, territories, leading to the generation of entrepreneurial ecosystems as part of a community (Cohen 2006).

This phenomena reflects not only a better capacity to face competitiveness but also more mobility for goods, services, capital, information and technology with intensification of exchanged knowledge and, consequently, creating more added value. As for Karlsson (2008), "resource-based" models emphasize the importance of labor supply in knowledge-intensive business as their primary location factors. Skills promote sustainable competitive advantages, increasing the expertise level of regions or countries, in particular when clusters accumulate different forms of knowledge (internal or external one). In this context, not only the theories of agglomeration of firms, i.e. clustering, internal economies of scale and size of the potential internal and external market regions, are used as the main factors to explain the effect of spatial clustering of firms. Knowledge flows also justify the intensification of clustering advantages, promoting networking systems and increasing external economies to add up to the internal economies of scale.

A given cluster may face both internal and external risks: Internal threats can originate in rigidities develop as a consequence of the obsolescence of technologies, of inadequate infrastructure, but also of the long lasting deficient conditions of labor's training and education or even in the inflexibility of the governance and regulatory systems (Porter, 1990b). External pressures are much more difficult to surpass and include economical and financial crises, abrupt technological changes, and alterations in political strategy or regulations (Karlsson, Johansson and Stough, 2005).

Besides the impact that clustering has upon the efficiency of business performance, there is also a correlation of these on the readiness of companies to innovate. As largely accepted, innovation is a complex activity profiting from knowledge and in particularly from new knowledge – this resulting from a cumulative and re-interpretative process. Part of this knowledge, reaching the firm from external sources (Cassiman and Veugelers, 2002 and 2006), serves as a crucial factor to promote innovation activity (Rosenberg and Frischtak, 1986). Over the last decades, the importance of knowledge generated outside the firm for its own use has increased significantly, but the simple contact to external sources of knowledge is not enough to generate success and, in particular, to sustain innovative activities.

Many authors described external knowledge flows as an aid to strategic decision-making at the firm level (Cohen and Levinthal, 1989; Cassiman and Veugelers, 2002 and 2006). But the firms have a certain absorptive capacity that limits them or enhance them when facing external knowledge.

The concept of networks, further then clustering, facilitates the absorptive capacity of the firm making its external knowledge base a result of other factors such as: the density of firms clustered in a given geographical area; the sector of activity; the social ties; the nature of the exchanged knowledge, for example.

It is also important to emphasize that firms exposed to the same amount of external knowledge flows differ in their ability to identify and exploit such flows (Giuliani and Bell, 2005). Thus, both the amount and effect of external knowledge flows are unequally distributed across the population of firms of a same cluster and the absorptive capacity of a company can still be a source of a firm's competitive advantage. A firm's absorptive capacity depends on its existing knowledge stock, much of which is embedded in its products, processes and people (Escribano et. al, 2009)

3. The Role of Spatial Analysis for Business Topographies

The importance of the geographical area discussed in the previous section for transformation and adaptation of the business landscape, enables the possibility to understand underlying patterns of changes in the topological characteristics of the entrepreneurial ecosystems. The entrepreneurial ecosystem, part of the business landscape, holds a dynamic contribution to the generation of economic growth, but has its own individual motivations intrinsically part of the competitive agenda of businesses. In this sense, it is an ecosystem, where competitive and clusters organize and readjust to the needs of the market. Strict visualization or static understanding of the geographical properties of the business landscape is thus, not enough for a complete and ubiquitous understanding of the topology of business performance, but should inter alia, be connected with advanced methodologies to support a clearer understanding of the changing patterns and the implied patterns on the landscape. This is fundamentally the role of Geographic Information Systems (GIS) where the largest contribution resides in spatial analysis, allowing for a coherent understanding of the dimensions of change over time and space (Anselin, 1995). Spatial analysis has the unique advantage of understanding and filtering underlying patterns in space at a reasonable cost, thanks to the recent advances in computational technologies (Anselin and Getis 1992). Concerning the location and relations formed between business, at an administrative scale, this allows generating a systemic understanding of the morphology of the business landscape, as well as determine hidden patterns that share a common understanding on economic viability of entrepreneurial ecosystems. The integration of Geographic Information Systems as support tools, allow for integration of several different datasets, that besides location of business, may also help in forming an explicit notion of the performance of the business sector. This has been largely used for customer and marketing research, but however, not assessed in an inter-business

framework, between the general and more macroeconomic understanding of the entrepreneurial landscape. Over space and time, spatial analysis is thus an utmost important contribution to understand the dynamics of socio-economic and entrepreneurial performance, where at a large scale, better understanding of relationships of formed clusters can become evident. Support of relations of clusters in the entrepreneurial landscape are found in the notions of spatial autocorrelation, where the relation of proximity between neighbours but also the integration of several sets of variables over space, generate a stronger or weaker link of the importance of location.

4. Methodology

Four major components were considered to develop the spatial analysis of the business landscape in India. The first consisted of gathering the data from two distinct sources. Initially, OpenStreetMap (OSM) data was used to incorporate the entire road network for Mumbai. Given the complexity of extrapolating such a large dataset, this can only be accomplished by means of a framework of large-scale activity such as Volunteered Geographic Information (VGI), where individuals act as intelligent sensors and are able to manipulate, add, and edit spatial datasets. This process took approximately five hours of computational download time, leading to an extraction of the main road networks, and removing peripheral roads from Mumbai (Figure 1).

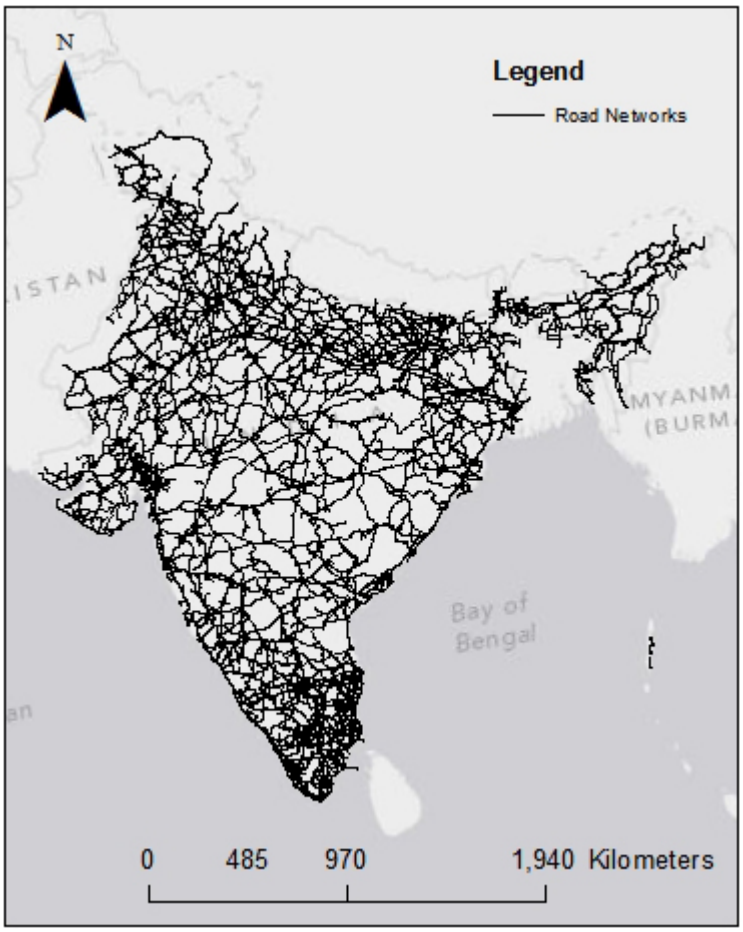

Figure 1 – Filtered road networks in India

The removal and editing of peripheral roads was carried out in ArcGIS 10 and from overlaid high resolution satellite imagery, which permitted a visual disaggregation of road types. Without the aid of VGI, this study would have been impossible given the complexity and the quantity of road networks for India, and the difficulty in manually digitising the commute systems for the entire country. In this sense, VGI played a major role in incorporating the business landscape in terms of geocoding of the 3561 addresses of registered businesses. The existence of VGI repositories contribute for a fundamental change in the way we deal with spatial information, but must also be handled carefully as to guarantee the quality and credibility of such datasets (Flanagin and Metzger 2008). However the notion of a collective spatial repository allows for a panoply of available spatial information which in most of the cases, seems to be fairly accurate concerning the topological and spatial characteristics of

certain features, such as commutes and motorways when compared to traditional sources of spatial data (Haklay 2010). The main motivation of VGI resides in the transversal profiles of users and the quantity of active volunteers, contributing as 'human sensors' (Goodchild, 2007) leading to a better understanding of the geographical and spatial reality at different scales. This may be of extreme importance for business performance, where the spatial dimension at may represent the social perception of importance and priorities in embedding as VGI components spatial information. In the case of India, comparison with higher resolution imagery through exporting the vector polylines corresponding to the road networks to Google Earth, allowed for an assessment of the quality and accuracy of the volume of present road networks in India. The secondary road networks as well as unclear classifications were discarded. Postal addresses were converted into a latitude and longitude values to have a geographic coordinates. This was performed by running an algorithm through the manually elaborated excel spread sheets, exporting the original document to a CSV sheet and importing the results through Yahoo maps. The latitude and longitude indices generated corresponded to a vector point with location of the business. A filter of incomplete addresses was and misinterpreted data was generated as to remove misclassifications from the spatial layer. This allowed equating a set of 3000 points all over India, corresponding to correctly classified, registered businesses. A final assessment to validate the classification of the business was carried out by means of a random selection of one 10% of the sample. These points were then projected onto Google Earth, and ancillary crowd sourced information as well as volunteered geographic information was compared, as to confirm attributes such as exact location, street number, and additional information of the location of business. This first step was the most demanding in terms of correct analysis and filtering of results, however it was the least demanding in terms of computational power. The second step consisted in performing a integration of a spatial density relationship through the assessment of different

spatial clustering techniques, in a deductive approach to autocorrelation. This led to an understanding of the clustering of business for India, through a global Moran´s I test statistic (Tiefelsdorf and Boots 1997) testing if there were some significant clusters formed over space and the relation with the existing networks following by assessment of presence of autocorrelation of pairs of businesses as well as he relation to existing commutes, corresponding thus to a local Moran´s I statistic. This step led to the analysis of distance from businesses, as a correspondence to a nearest neighbour analysis where an initial distance was calculated to ensure the existence of at least one neighbour. The confidence interval for this distance for calculating a Moran autocorrelation index corresponded to 180 km, ensuring the confidence interval needed for an autocorrelating neighbour within the area (Figure 2).

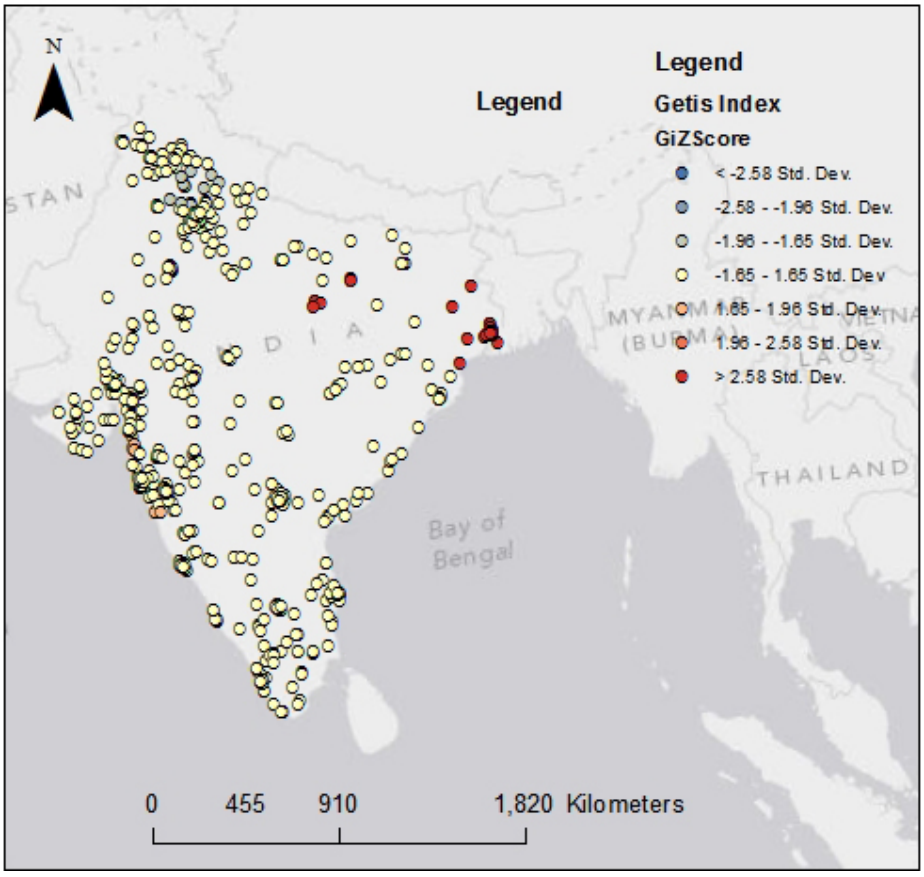

Figure 2 – Local G Statistic and identification of cold and hot spots

The Moran autocorrelation index proved that at a distance of 250 km there is a greater likelihood in forming a cluster between sites, suggesting the existence of Hot and Cold spots in India for Business activity.

5. Discussion

The case of India is of particular interest to investigate, given the existence of little available digitized data sources. In this sense, India presents itself as a country blossoming with entrepreneurial opportunities, but with little digital information to help in decision making support or in understanding the underlying geographical patterns of business performance and location. The combination of VGI information for India showed the large progress in available spatial information which may be used for different large scale studies. The existence of a large young and informed population throughout the Indian continent, allows to source of geographic data through VGI much better than expected by regular commercial sources that often are unavailable. Spatial analysis in this sense is an utmost important tool, permitting a better understanding of the topology of space, but also of anthropogenic activity. In the case of India it has become quite clear that there are several hotspots for business performance which are statistically significant.

6. Conclusion

The present study assessed the distribution of business location in India using autocorrelation techniques and defining what we call business topography. The usage of volunteered geographic information is of crutial importance to understand the dynamics with large set and often complex sets of spatial data such as the location of business in relation to the distance

of roadnetworks. The distance of road networks as well as the location of business and their intrinsic relations to their nearest neighbour, allowed to generate an understanding of the key hotspots that are currently of major importance for India's business performance. From a dynamic perspective, it is quite probable that distance from main commutes continues to be of key importance for India's business development. The study showed that the spatial influence in autocorrelation of location of all types of business in India, area of utmost importance. It is expected that this trend will continue over time, developing hubs for business and entrepreneurial activity for the future generations of Indian entrepreneurs. The combination of spatial analysis techniques with geocoded information and VGI will play major importance for combinatory analytics of economic landscapes and defining at country level tendencies for economic performance and relations of industry and business sectors. In this sense, Geographic Information Systems can play a key role in better understanding the influence of location and combination of other derived spatial variables in relating for the potential of business topographies at country level. The present study has furthermore advanced in a new type of understanding of spatial information: a combinatory approach to VGI datasets with entrepreneurial ecosystems and the relation to areas where little data is available. These combined methodologies support novel tools to assess and interpret spatial change over time, and augment the possibilities of creating functional synergies in the interdependencies and generated value of business hubs located in the entrepreneurial ecosystems.

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